

6. COREMATODUS.

Corematodus, Bouleng. Proc. Zool. Soc. 1896, p. 918.

Body short; scales cycloid. Jaws with extremely broad bands of innumerable minute club-shaped teeth with compressed oblique entire crowns. Dorsal with 16 spines, anal with 3. Vertebrae 32 (15+17).

A single species.

1. COREMATODUS SHIRANUS.

Corematodus shiranus, Bouleng. op. cit. p. 919, cum fig.

Depth of body equal to length of head, $\frac{1}{3}$ total length. Snout very broad, with steep, convex profile; eye a little nearer gill-opening than end of snout, its diameter $4\frac{1}{2}$ times in length of head, twice in interorbital width, and greater than depth of præorbital; maxillary extending to below anterior border of eye; cheek with 4 rows of scales below the eye; opercle and interorbital region scaleless; limbs of præopercle forming a right angle. Gill-rakers moderately long, 12 on lower part of anterior arch, last bifid. Dorsal XVI 10; spines increasing in length to the last, which is $\frac{2}{3}$ length of head. Anal III 8; third spine longest, as long as but thicker than middle dorsals. Caudal peduncle $1\frac{1}{2}$ as long as deep. Scales slightly rugose, not denticulate, $34\frac{3}{9}$; lat. l. $\frac{20}{2}$. Body with traces of six black cross-bars.

Total length 200 millim.

Upper Shiré River.

EXPLANATION OF PLATE XIX.

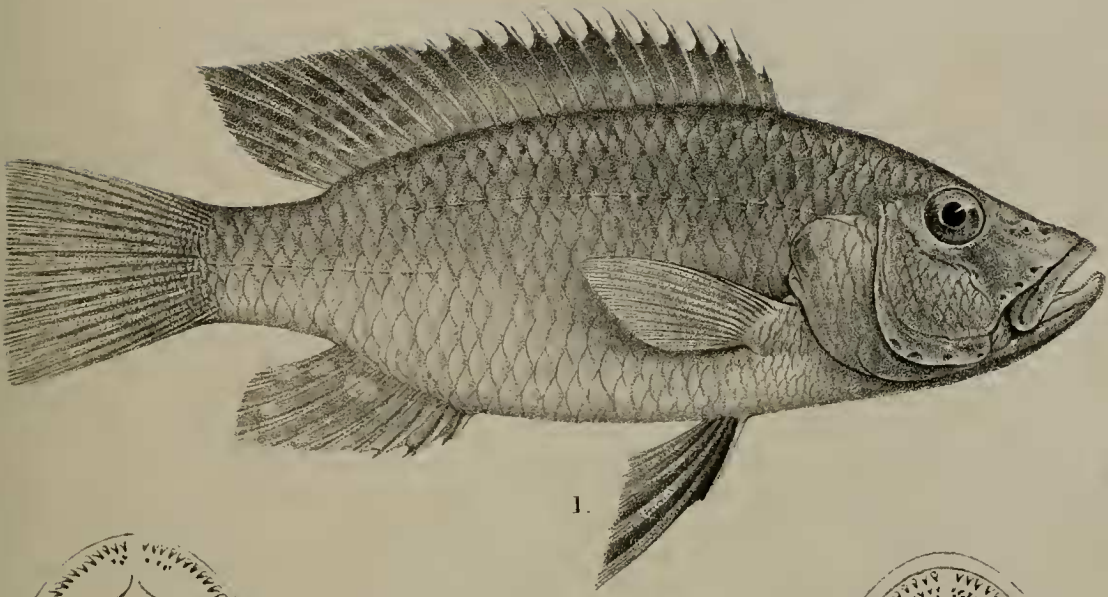
Fig. 1. *Pelmatochromis welwitshi* Blgr., p. 149. 1a. Jaws, $\times 3$.

Fig. 2. *Chromidotilapia kingsleyæ* Blgr., p. 151. 2a. Jaws, $\times 3$. 2b. Gill-chamber, seen from below the opercle, $\times 2$.

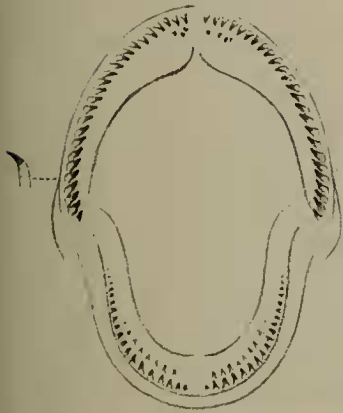
3. The Myology of the Terrestrial Carnivora.—Part II.
By B. C. A. WINDLE, M.A., M.D., D.Sc., Professor of Anatomy at Mason University College, Birmingham, and F. G. PARSONS, F.R.C.S., F.Z.S., F.I.L.S., Lecturer on Comparative Anatomy at St. Thomas's Hospital, and Hunterian Professor at the Royal College of Surgeons.

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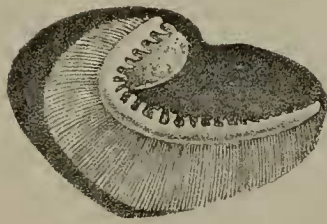
The first part of this paper was read before this Society on April 6th last year (see P. Z. S. 1897, p. 370); it contained an account of the muscles of the head, neck, and fore-limb. The present part contains a description of the muscles of the hind-limb and trunk. As we have been able to dissect some additional



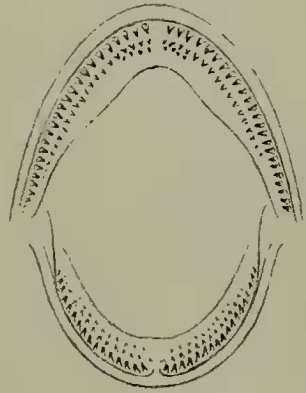
1.



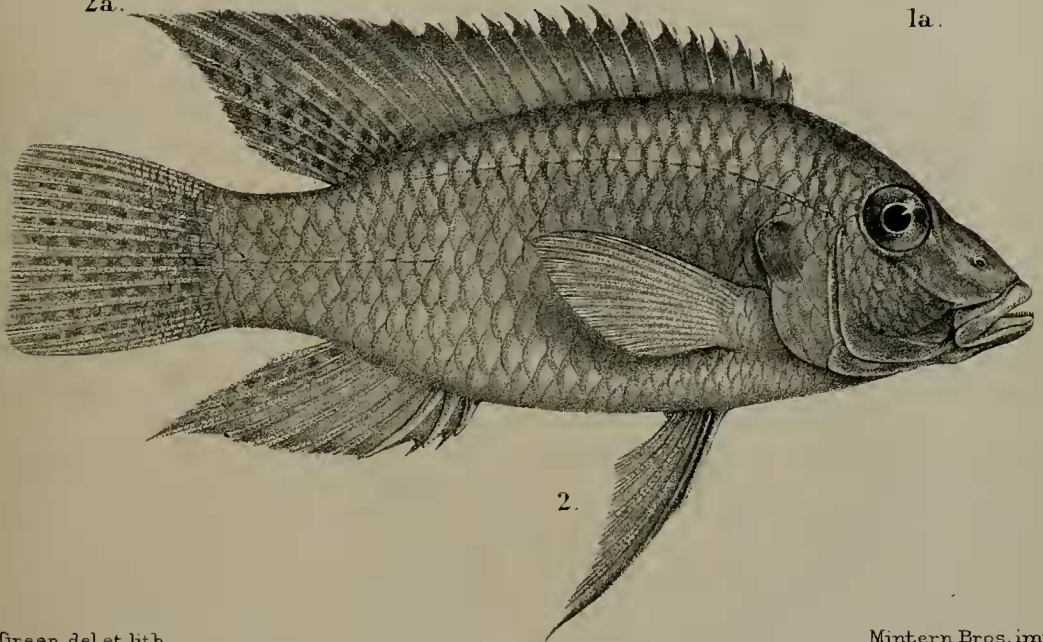
2a.



2b.



1a.



2.



animals since our last communication, a new list has become necessary, and we would again draw attention to the fact that the small numbers before each animal's name refer to mentions of it in the text, while the Roman numerals after the name refer to the bibliography at the end of the paper. When no Roman numeral is present the animal has been dissected by ourselves.

List of Animals.

FELIDÆ.

1. Lion (*Felis leo*). Macalister (unpublished).
2. Lion (*F. leo*). (V.)
3. Lion (*F. leo*). (III.)
4. Tiger (*F. tigris*). Macalister (unpublished).
5. Leopard (*F. pardus*). Macalister (unpublished).
6. Leopard (*F. pardus*).
7. Leopard (*F. pardus*). (VI.)
8. Ocelot (*F. pardalis*).
9. Cat (*F. catus*). (I.)
10. Cat (*F. catus*). (II.)
- 10 a. Cat (*F. catus*). (XXXIX.)
11. Caracal (*F. caracal*). (XXIX.)
12. Cheetah (*Cynelurus jubatus*). (IV.)

VIVERRIDÆ.

13. Fossa (*Cryptoprocta ferox*).
14. Fossa (*C. ferox*).
15. Fossa (*C. ferox*). (VII.)
16. Civet (*Viverra civetta*). (VIII.)
17. Civet (*V. civetta*). (IX.)
18. Civet (*V. civetta*). (X.)
19. Rasse (*Viverricula malaccensis*).
20. Blotched Genet (*Genetta tigrina*). (XI.)
21. Blotched Genet (*G. tigrina*).
22. Blotched Genet (*G. tigrina*). (XII.)
23. Common Genet (*G. vulgaris*).
24. Common Genet (*G. vulgaris*).
25. Palm Civet (*Paradoxurus typus*).
26. Palm Civet (*P. typus*).
27. Palm Civet (*P. typus*). (XXIX.)
28. Ichneumon (*Herpestes* sp. inc.). (XXXIX.)
29. Ichneumon (*H. nepalensis*).
30. Ichneumon (*H. griseus*).
31. Thick-tailed Mongoose (*Cynictis penicillata*).
32. Aard Wolf (*Proteles cristatus*). (XIII.)

HYÆNIDÆ.

33. Striped Hyæna (*Hyæna striata*). (XIV.)
34. Striped Hyæna (*H. striata*). (XXXIX.)

- 35. Striped Hyæna (*H. striata*). (XVI.)
- 36. Striped Hyæna (*H. striata*).
- 37. Spotted Hyæna (*H. crocuta*). (XV.)
- 38. Brown Hyæna (*H. brunnea*). (XVII.)

CANIDÆ.

- 39. Dog (var. Fox-terrier) (*Canis familiaris*).
- 40. Dog (var. Fox-terrier) (*C. familiaris*).
- 41. Dog (var. Irish Terrier) (*C. familiaris*) XVIII.)
- 42. Dog (var. Greyhound) (*C. familiaris*). (XVIII.)
- 43. Dog (var. Greyhound) (*C. familiaris*). Macalister (unpublished).
- 44. Dog (var. Pointer) (*C. familiaris*). Macalister (unpublished).
- 45. Dog (var. Setter) (*C. familiaris*). Macalister (unpublished).
- 46. Dog (var. Bull-dog) (*C. familiaris*). Macalister (unpublished).
- 47. Dog (? var.) (*C. familiaris*). (XXXIX.)
- 48. Dog (? var.) (*C. familiaris*). (XIX.)
- 49. Dingo Dog (*C. dingo*). (XVIII.)
- 50. Common Jackal (*C. aureus*). Macalister (unpublished).
- 50 a. Common Jackal (*C. aureus*).
- 51. Black-backed Jackal (*C. mesomelas*).
- 52. Common Fox (*C. vulpes*). (XXXVIII.)
- 53. Arctic Fox (*C. lagopus*). Macalister (unpublished).
- 54. Cape Hunting Dog (*Lycaon pictus*). (XL.)

URSIDÆ.

- 55. Polar Bear (*Ursus maritimus*). (XXIV.)
- 56. Polar Bear (*U. maritimus*). (XXXIX.)
- 57. Brown Bear (*U. arctos*). (XXXIX.)
- 58. Black Bear (*U. americanus*).
- 59. Black Bear (*U. americanus*). (XX.)
- 60. Black Bear (*U. americanus*). (XXIII.)
- 61. Black Bear (*U. americanus*). (XXI.)
- 62. Black Bear (*U. americanus*). (XXII.)

PROCYONIDÆ.

- 63. Common Racoon (*Procyon lotor*).
- 64. Common Racoon (*P. lotor*). (XXVI.)
- 65. Common Racoon (*P. lotor*). (XXVI.)
- 66. Common Racoon (*P. lotor*). (XXXIX.)
- 67. Crab-eating Racoon (*P. cancrivorus*). (XXV.)
- 68. White-nosed Coati (*Nasua narica*). (XXVII.)
- 69. Brown Coati (*Nasua fusca*). (XXVII.)
- 70. Red Coati (*N. rufa*). (XXVIII.)
- 71. Coati (? sp.) (*Nasua*) Meckel. (XXXIX.)
- 72. Kinkajou (*Cercoleptes caudivolvulus*).
- 73. Kinkajou (*C. caudivolvulus*).
- 74. Kinkajou (*C. caudivolvulus*). (XXIX.)

MUSTELIDÆ.

75. Grison (*Galictis vittata*).
76. Tayra (*G. barbara*). (IX.)
77. Polecat (*Mustela putorius*). (XXX.)
78. Beech Marten (*M. foina*). (XXXI.)
79. Beech Marten (*M. foina*). (XXVII.)
80. Beech Marten (*M. foina*). (XXVII.)
81. Beech Marten (*M. foina*). (XXXIX.)
82. Beech Marten (*M. foina*). (XXIX.)
83. Cape Polecat (*Ictonyx zorrilla*).
84. Libyan Polecat (*I. libyca*).
85. Badger (*Meles taxus*). Macalister (unpublished).
86. Badger (*M. taxus*). (XXXIII.)
87. Badger (*M. taxus*). (XXXIX.)
88. Common Otter (*Lutra vulgaris*).
89. Common Otter (*L. vulgaris*). (XXXVI.)
90. Common Otter (*L. vulgaris*). (XXXV.)
91. Common Otter (*L. vulgaris*). (XXXIX.)
92. Common Otter (*L. vulgaris*). (XXXIV.)
93. Indian Otter (*L. cinerea*) (XXXVII.)

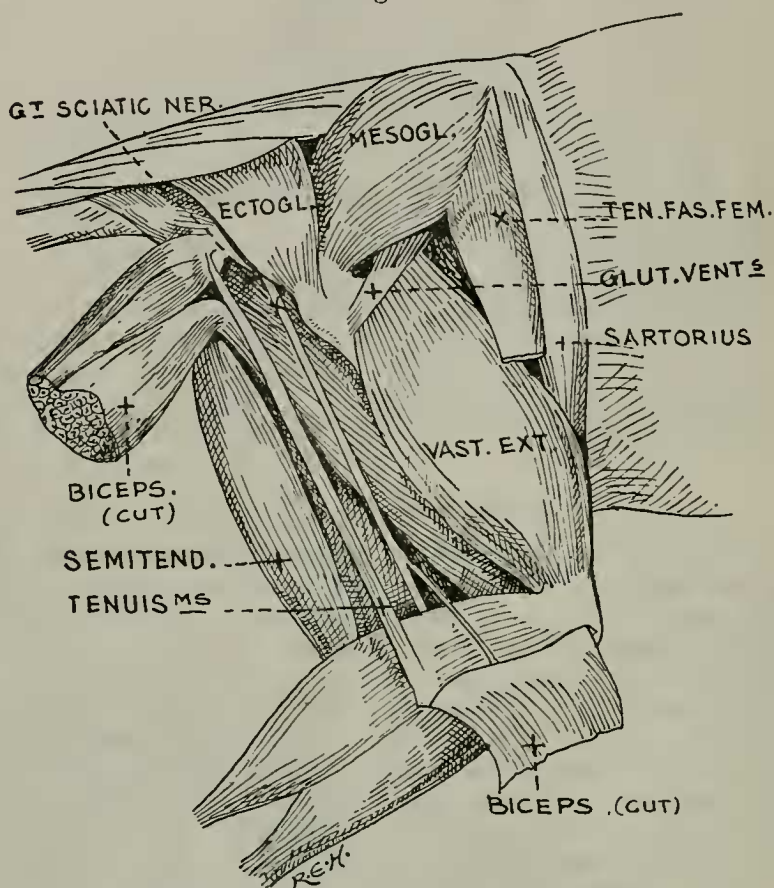
Muscles of the Hind Limb.

Ectogluteus (*Gluteus maximus*).—This muscle is fairly constant in the Carnivora, it rises from the posterior two or three sacral spines and from the transverse processes of a like number of caudal vertebræ. Occasionally it derives a slight origin from the ilium. It is inserted into the femur, usually just below the great trochanter, as well as into the fascia lata. Anteriorly its edge is continuous with that of the tensor fasciæ femoris, posteriorly with that of the biceps; indeed, the sartorius, tensor fasciæ femoris, ectogluteus, and biceps form a muscular sheath round the outer two-thirds of the thigh, and it is often quite difficult to determine where one muscle ends and the other begins. Among the Felidæ the foregoing description applies to *Felis leo* (1, 2, 3), *F. tigris* (4), *F. pardus* (5, 6, 7), *F. pardalis* (8), *F. catus* (9), and *Cynelurus* (12). Among the Viverridæ it applies to *Cryptoprocta* (13, 14), *Viverra* (17), *Viverricula* (19), *Genetta tigrina* (20), *G. vulgaris* (23, 24), *Paradoxurus* (25, 26), *Herpestes nepalensis* (29), *H. griseus* (30), and *Cynictis* (31).

Young (VIII.) describes the muscle in *Viverra* (16) as being inserted into the whole length of the shaft of the femur, though this description probably includes the agitator caudæ. Cuvier and Laurillard (XII.) found the muscle divided into three parts in *Genetta tigrina* (22); of these one is evidently the agitator caudæ, while the rest consists of a superficial and a deep layer. This arrangement is clearly exceptional, as it was not noticed in any other specimen of Genet. *Proteles* (32) seems to differ from the typical arrangement in not having the ectogluteus continuous with the biceps.

Among the Hyænidæ, Meckel notices a separation between the sacral and caudal parts of the muscle in *Hyæna striata* (34), and the same arrangement is recorded by Young (33) and, in *Hyæna crocuta*, by Watson (37).

Fig. 1.

External muscles of thigh of *Canis familiaris*.

Among the Canidæ the typical arrangement exists in *Canis familiaris* (39, 48), *Canis aureus* (50 a), and *Canis mesomelas* (51), except that the ectogluteus and tensor fasciæ femoris are separated by a considerable interval (see fig. 1). In the Ursidæ, Kelley (XXIV.) states that there is no fascial insertion in *Ursus maritimus* (55), while Shepherd (XX.), in *Ursus americanus* (59), found almost the whole muscle inserted into fascia, so that further observations on this point are necessary. The Procyonidæ are remarkable for having the ectogluteus inserted almost entirely into bone just below the great trochanter; this applies to *Procyon* (63, 64, 65), *Nasua* (68, 70), and *Cercoleptes* (72). The same arrangement exists among the Mustelidæ in *Mustela foina* (78), *Ictonyx* (84), *Meles taxus* (86), and *Lutra* (88, 93).

The *Caudo-femoralis* (*Agitator caudæ*) is an intermediate muscle between the ectogluteus and the biceps, though it is usually more closely associated with the former than the latter; in some cases it is a perfectly distinct muscle, while in others no trace of it is recorded. By many authors its presence seems to have been entirely ignored, though others have evidently noticed it and described it as a part of the ectogluteus. It seems to have very little action on the tail and, for this reason alone, its name is not a particularly happy one; it is further liable to objection for the following reason—if the muscle does act on the tail its crural attachment must be considered the origin and its caudal the insertion: this is just the opposite to the manner in which the attachments of the ectogluteus and biceps are, we think rightly, described. For these reasons we prefer the name of caudo-femoralis for this muscle. The origin is from the anterior two or three caudal vertebræ, either continuous with, or deep to, the ectogluteus, while the insertion may be anywhere into the shaft of the femur, from the middle to just above the external condyle or, in some cases, as low as the patella.

Among the Felidæ the muscle is present in *Felis leo* (1, 2, 3), and is in each case inserted into the patella. The same description applies to *Felis tigris* (4) and *Felis pardus* (5, 6, 7). In *Felis pardalis* (8) we found the caudo-femoralis very well marked, part of it being inserted into the back of the femur and part into the patella, these two parts were united at their origin and supplied by the same nerve. In *Felis catus* the muscle is figured by Mivart (I.) and Straus-Durckheim (II.), though not specially described; its insertion does not seem to reach the patella in this animal.

Among the Viverridæ the muscle is very constant and is usually inserted into the lower third of the shaft of the femur. It is present in *Cryptoprocta* (13, 14, 15), *Viverra civetta* (16, 17), *Viverricula malaccensis* (19), *Genetta* (20, 22, 23), *Herpestes* (29), and *Cynictis* (31). In two specimens of *Paradoxurus* (25, 26) and one of *Genetta* (24), the muscle was double. *Herpestes griseus* (30) was the only member of the Viverridæ in which the muscle was carefully looked for and not found. Among the Hyænidæ we can find no record of the presence of this muscle. *Proteles* (32) is described as agreeing with *Hyæna crocuta* (37) in its gluteal muscles, and in the latter animal no caudo-femoralis seems to have existed. Among the Canidæ we have records of six Dogs (39, 43, 44, 45, 46, 48) in which the muscle was looked for but in none of which was it found (see fig. 1). It is not present either, as a distinct muscle, in *Canis aureus* (50, 50 a), *Canis mesomelas* (51), or *Canis lagopus* (53), while Pagenstecher (XL.) makes no mention of it in *Lycæon* (54).

We have been unable to find the caudo-femoralis or any mention of it in the Ursidæ.

Among the Procyonidæ the muscle is absent in *Procyon lotor* (63, 64, 65), but is present and inserted into the lower part of the femur in *Nasua* (68, 69, 70) and *Cercoleptes* (72). It is present

among the Mustelidæ in *Mustela foina* (78), one specimen of *Meles* (85), and *Lutra cinerea* (93), but absent in *Ictonyx* (84), one specimen of *Meles* (86), and *Lutra vulgaris* (88). We are therefore inclined to regard this muscle as being constant and usually attached to the patella in the Felidæ, constant and attached to the femur in the Viverridæ, present or absent in the Procyonidæ and Mustelidæ, absent in the Canidæ, Hyænidæ, and Ursidæ.

Tensor fasciæ femoris.—This, as we have already pointed out, is the ventral continuation of the ectogluteus. It rises from the crest of the ilium and is inserted into the fascia lata about the middle of the outer side of the thigh, mesially it is continuous with the sartorius. Its degree of development varies greatly in different animals and apparently in different specimens of the same animal; for this reason we have decided not to describe it in detail throughout the order. In one specimen of *Felis pardus* (5) it reached the patella, while in *Ictonyx lybica* (84) it could not be made out at all. Macalister found it divided into an external and internal part in a Dog (43).

Mesogluteus (*Gluteus medius*).—This muscle, as in most mammals, is by far the largest of the glutei; it rises from the dorsal part of the gluteal surface of the ilium as well as from the fascia lata covering it. Its insertion is into the outer side of the great trochanter, and it lies in such close relationship to the pyriformis that that muscle can only be separated from it with great difficulty. In some cases, e. g. *Hyæna crocuta* (37), *Canis aureus* (50), and *Procyon lotor* (64), the muscle is distinctly bilaminar.

Entogluteus (*Gluteus minimus*) rises from the ventral part of the gluteal surface of the ilium and is inserted into the front of the great trochanter. It is part of the same layer as the obturator internus and gemelli, and is quite constant in all the Carnivora.

Gluteus ventralis (*Scansorius*, *Gluteus quartus*).—This is a differentiation of the ventral fibres of the entogluteus, and rises from the ventral border of the ilium, close to the origin of the rectus femoris, and is inserted into the lower part of the front of the great trochanter in the region of the anterior introchanteric or spiral line of the femur. Some writers, following the example of Macalister, call this muscle the gluteus quintus, and use the term gluteus quartus for another differentiation of the entogluteus; for this reason it seems best to avoid the terms quartus and quintus and to speak of this muscle as the gluteus ventralis. Among the Felidæ the muscle was found in *Felis leo* (1) by Macalister, but is not mentioned by Haughton (3), or figured by Cuvier and Laurillard (2). It is also present in *Felis pardus* (5, 6), *Felis catus* (10, 11), and *Cynelurus jubatus* (12). Among the Viverridæ it was present in *Cryptoprocta* (13), *Viverra* (17), *Viverricula* (19), *Genetta* (20, 22, 23, 24), *Paradoxurus* (25), *Cynictis* (31), and *Proteles* (32). In *Paradoxurus* (26) and *Herpestes* (30) it was not found. In *Hyæna striata* among the Hyænidæ the muscle was found by Meckel (34), but not by Young and Robinson (33). In *Hyæna crocuta* (37) it was present. Among the Canidæ it was found in two specimens

of *Canis familiaris* (45) out of six (see fig. 1). It was absent in *Canis aureus* (50, 50 a), *Canis mesomelas* (51), *Canis lagopus* (53), and *Lycan pictus* (54).

In the Ursidæ Shepherd and Cuvier and Laurillard noticed it in *Ursus americanus* (59, 62). Among the Procyonidæ it was absent in *Procyon lotor* (63, 64, 65) and *Nasua narica* (68), but was found in *Nasua fusca* (69) and *Cercoleptes* (72); while among the Mustelidæ it was found in *Galictis vittata* (75), *Galictis barbara* (76), *Meles* (85, 86), and *Lutra* (88, 93), but was not seen in *Ictonyx libyca* (84). From the foregoing we are of opinion that the gluteus ventralis may be distinguished from the entogluteus, if carefully looked for, in most of the Carnivora.

Gluteus profundus (*Gluteus quintus, ilio-capsularis*).—This small muscle is described very accurately by Douglas¹ in the Dog. It rises from the ilium just above the acetabulum, and passes over the capsule of the hip-joint to be inserted into the upper part of the anterior surface of the shaft of the femur, between the origins of the vastus internus and crureus. We have records of the presence of the muscle in the following animals:—*Felis pardus* (6), *Felis pardalis* (8), *Cynelurus* (12), *Genetta vulgaris* (24), *Cynictis penicillata* (31), *Hyæna striata* (36), *Canis familiaris* (44, 45), *Canis aureus* (50), and *Meles taxus* (85). Owing to its small size it is easily overlooked, and our notes do not enable us to say whether it is constantly absent in any special genus or family.

Pyriformis.—This muscle, as has already been mentioned, is frequently so blended with the mesogluteus as to be with difficulty made out. If the origin from the sacrum, however, be carefully looked for, the muscle can usually be separated. It seems to be a very constant muscle in the Carnivora, rising from the ventral surface of the sacrum and being inserted into the top of the great trochanter. Apart from its greater or less degree of distinctness, we have met with no special variations.

Obturator internus.—This has the human origin and insertion. Where the tendon passes round the lesser sacro-sciatic notch its deep surface is marked by five or six ridges separated by furrows.

Gemelli.—In the Carnivora the two gemelli are seldom, if ever, separate; they form a continuous origin from the ventral edge of the lesser sacro-sciatic notch, and lie deep to the obturator internus, overlapping it in front and behind. The anterior part, which corresponds to the superior gemellus of human anatomy, is usually the larger, though in one specimen of *Lutra* (88) only the posterior gemellus was present; this, however, appears to have been an individual variation.

Obturator externus.—This rises from the outer surface of the obturator membrane, but much more strongly from the bone on the dorsal and posterior margins of the foramen. It is inserted as usual into the digital fossa of the great trochanter. We have met with no variations of it.

¹ 'Descriptio Musculorum,' 1738, p. 146.

Quadratus femoris.—A large and fleshy muscle rising from the tuberosity and ramus of the ischium, and being inserted into the inter-trochanteric line of the femur as well as the surface of bone below on a level with the lesser trochanter. As a rule it is quadrilateral, but sometimes the insertion is narrower than the origin; this, however, seems to depend very little on the relationships of its possessor. Watson (XIII.) describes the muscle as wanting in *Proteles*.

Ilio-tibialis (Sartorius).—This rises from the ventral portion of the crest of the ilium and is inserted into the inner side of the patella, ligamentum patellæ, and cnemial crest of the tibia. In many of the Carnivora it is double, and when this is the case the anterior part is usually inserted into the patella, the posterior into the tibia.

Among the Felidæ the muscle is apparently always single; this is the case in *Felis leo* (1, 2), *F. tigris* (4), *F. pardus* (5, 6, 7), *F. pardalis* (8), and *F. catus* (9).

Among the Viverridæ the muscle may be single or double. In the following it is single:—*Cryptoprocta* (13, 14), *Viverra* (16), *Genetta* (24), and *Herpestes* (30). In the following it is double:—*Viverra* (17), *Viverricula* (19), *Genetta* (20, 22, 23), *Paradoxurus* (25, 26), and *Herpestes* (29). In *Cynictis* (31) the two parts are united by fascia, while in *Proteles* (32) the muscle divides near its insertion. In the specimen of Genet (23) which we dissected the muscle was bilaminar, the superficial part going to the tibia, the deep part to the fascia over the rectus and vastus internus in the middle of the thigh.

Among the Hyænidæ the ilio-tibialis is always double:—*Hyæna striata* (33, 35, 36) and *H. crocuta* (37). In *Hyæna striata* (33, 36) the shorter part joins the rectus and acts as a fifth head of the quadriceps extensor.

Among the Canidæ the muscle is also double; this was the case in the following eight specimens of *Canis familiaris* (39, 41, 42, 43, 44, 45, 46, 48), in *C. aureus* (50, 50 a), in *C. mesomelas* (51), and *C. lagopus* (53).

In the Ursidæ it seems to be usually single; this is the case in *Ursus arctos* (57) and *U. americanus* (59, 60, 62).

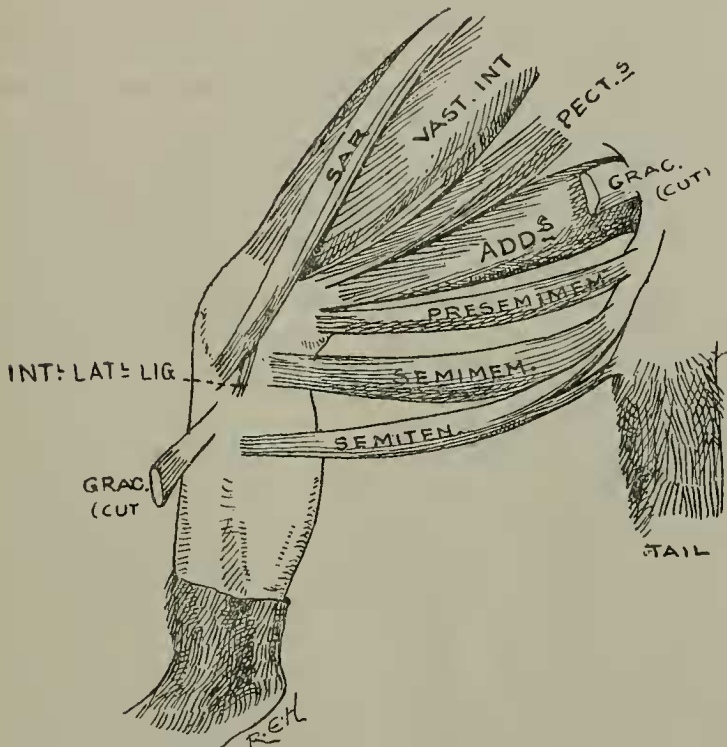
Among the Procyonidæ it is single in *Procyon lotor* (63, 64, 65, 66), *P. cancrivorus* (67), and *Cercoleptes* (72). In *Nasua narica* and *fusca* (68, 69) it divides at its insertion according to Mackintosh, but in Cuvier and Laurillard's plate of *Nasua rufa* (70) the muscle is single.

In the Mustelidæ it is single in *Galictis vittata* (75) and *barbara* (76), *Mustela foina* (78, 82), *Ictonyx libyca* (84), *Meles taxus* (85, 86), and *Lutra* (88, 89, 90). Macalister also says that it is single in *Lutra cinerea* (93). It will thus be seen that the ilio-tibialis is always single in the Felidæ and very generally so in the Ursidæ, Procyonidæ, and Mustelidæ. In the Hyænidæ and Canidæ it is always double, while in the Viverridæ it may be single or double.

Adductor cruris (Gracilis).—This muscle is always single in the

Carnivora; it is broad and thin, and rises from the symphysis and posterior ramus of the pubes to be inserted into the cnemial crest of the tibia just below the insertion of the ilio-tibialis (sartorius), in most cases into the second quarter of the tibia (see fig. 2). In *Proteles* (32), Watson describes it as rising from the fascia over the adductores femoris, and being inserted into the tibia at the junction of the middle and lower thirds.

Fig. 2.

Inside view of thigh-muscles of *Herpestes*.

(The semimembranosus and pre-semimembranosus have been artificially separated.)

Pectineus.—This muscle, in many cases, is extremely difficult to separate satisfactorily from the superficial part of the adductor mass, and there can be little doubt that what one observer would describe as a large or double pectineus, another would call pectineus and adductor longus. We therefore feel quite incapable of dogmatizing on the subject and merely give the following notes for what they are worth. In *Felis leo* (2) Cuvier and Laurillard figure the muscle as double. In *Felis catus* (9) Mivart describes it as small, yet reaching halfway down the thigh. In *Cryptoprocta* (14) we found the muscle reaching halfway down the thigh and feebly separated into an outer and inner part; in another specimen of the same animal (13), which we examined, no separation could be

made out. In *Viverra civetta* (16) Young describes the muscle as large and bilaminar, but says that the superficial part may represent an adductor longus. Macalister says of the same animal (17), that the muscle is small and normal. In two specimens of Genet (20, 23), one of which we dissected ourselves, the pectineus was single and extended halfway down the thigh; in another (24) we found it divided into an inner and outer part. In *Herpestes* it reaches nearly to the lower end of the femur (see fig. 2).

In *Proteles* (32) and the Hyænidæ (33, 36, 37) the muscle is single and unilaminar.

In the Canidæ the same arrangement exists.

In the Ursidæ Cuvier and Laurillard describe the muscle in *Ursus americanus* (62) as dividing into three parts, but this arrangement has not been noticed by other observers.

Among the Procyonidæ we found the pectineus distinctly bilaminar in *Procyon lotor* (63). Allen (XXVI.) says of his two specimens of this animal (64, 65), that the pectineus and adductor brevis rise from the ilio-pectineal line and are both supplied by the anterior crural nerve; this origin and nerve-supply make us regard that which he speaks of as adductor brevis as one layer of the pectineus. In *Nasua* the condition of the muscle does not seem to have been noticed, but in *Cercoleptes* (72) we found it distinctly bilaminar. Among the Mustelidæ we have no records of a bilaminar muscle.

Adductor Mass (Adductores femoris).—This mass of muscles rises from the ventral surface of the body and posterior ramus of the pubes as well as from the ramus and tuberosity of the ischium; it is inserted into the whole length of the back of the shaft of the femur. We do not feel justified in attempting to divide this mass into the adductor longus, brevis, and magnus of human anatomy; sometimes it can easily be divided in four or five layers, at others it is impossible to divide it at all.

The *Semimembranosus* rises from the tuberosity of the ischium and is often closely fused with the adductor mass in the thigh. It is inserted into the internal tuberosity of the tibia, deep to the internal lateral ligament of the knee, by tendon. Some of the fibres are also inserted into just above the internal condyle of the femur and are separated from the adductor insertion by the femoral artery. This pre-semimembranosus or ischio-supracondyloideus is of special interest when compared with the same muscle in other animals. In the Rodents, for instance, it is often quite a separate muscle rising from the caudal vertebrae; in animals as far apart as man and the kangaroos it is intimately connected with the adductors, while in the macaque monkey it rises from the tuberosity of the ischium and is a distinct muscle down to its insertion. However it may vary in other respects, its insertion and nerve-supply from the sciatic are always constant. In the Carnivora the ischio-supracondyloideus is always part of the semimembranosus in the thigh, and always rises with that muscle from that tuberosity of the ischium, so that most writers describe the

semimembranosus in this order as having a femoral and a tibial insertion (see fig. 2).

Semitendinosus.—This always rises from the tuberosity of the ischium, but often has an extra head from the transverse processes of two or three of the anterior caudal vertebræ (see fig. 2). Where these two heads unite, in the upper third of the thigh, there is often a transverse tendinous intersection, e. g. *Genetta* (23), *Viverra* (17), *Herpestes* (30), *Nasua* (68), and *Lutra* (93). The insertion is into the inner side of the cnemial crest of the tibia just below that of the gracilis and into the fascia of the leg; the lower fibres are continued with those of the biceps down to the calcaneum, helping to encapsule the tendo Achillis.

In the Felidæ the caudal head is not present—*Felis leo* (2, 3), *F. pardus* (6, 7), *F. pardalis* (8), and *F. catus* (9). In the Viverridæ, if we except *Proteles*, the caudal head is always present in addition to the ischial one—*Cryptoprocta* (13, 14, 15), *Viverra* (16, 17), *Viverricula* (19), *Genetta* (20, 22, 23, 24), *Paradoxurus* (25, 26), *Herpestes* (29, 30), and *Cynictis* (31).

Among the Hyænidæ, with which *Proteles* as usual agrees, the caudal head is wanting—*Hyæna striata* (33, 35, 36), *H. crocuta* (37), and *Iroteles* (32).

Among the Canidæ there is no caudal origin in *Canis familiaris* (39, 48), *C. aureus* (50a), or *C. mesomelas* (51).

In the Ursidæ the same description applies—*Ursus americanus* (58, 59, 62). In the Procyonidæ the two heads are always present—*Procyon lotor* (63, 64, 65), *P. cancrivorus* (67), *Nasua narica* (68), *N. fusca* (69), *N. rufa* (70), and *Cercoleptes* (72, 73, 74).

Among the Mustelidæ the caudal head is sometimes present, sometimes absent. It is present in *Galictis vittata* (75), *Mustela foina* (78), *Ictonyx libyca* (84), and *Lutra* (88, 90, 93). Absent in *Ictonyx zorrilla* (83) and *Meles taxus* (86).

From the above it will be seen that the presence or absence of the caudal origin of the semitendinosus is very characteristic of different families of the Carnivora; it seems always to be present in the Viverridæ and Procyonidæ, always absent in the Felidæ, Hyænidæ, Canidæ, and Ursidæ, while in the Mustelidæ it is inconstant.

Flexor cruris lateralis (*Biceps femoralis*).—This muscle, as has already been pointed out, forms part of the same sheet as the ectogluteus and tensor fasciæ femoris, it is therefore difficult to decide whether certain bundles of fibres should be included in the description of the biceps or of the ectogluteus; this is especially the case with those fibres which are inserted into the lower end of the femur. The biceps in all cases rises from the tuber ischii, but it may be reinforced by an extra head from the caudal vertebræ; this head is quite distinct from the tenuissimus, which will be dealt with later, and from the caudo-femoralis, which has been already considered. The insertion is into the fascia of almost the whole of the outer side of the leg, the highest fibres going to the patella, while the lowest are continued down with the tendo Achillis, and

are often reinforced by some of the lower fibres of the semitendinosus. We do not propose to lay any stress on the presence or absence of the caudal head, since it is so difficult to determine whether it should be included with the ectogluteus or not, and we are uncertain what views other observers have taken of it.

Tenuissimus (Bicipiti accessorius).—This, as its name implies, is a slender ribbon-like muscle which usually rises from the first caudal vertebra and passes down the back of the thigh and leg, deep to the biceps and superficial to the great sciatic nerve. In the lower part of the leg it usually joins the lowest fibres of the biceps and, with them, is conducted down to the calcaneum, helping to ensheath the tendo Achillis. We should like here to call special attention to this prolongation of the flexor lateralis to the calcaneum with the tendo Achillis. The muscle passes over three joints, being an extensor of the hip, a flexor of the knee, and a plantar flexor of the ankle. It probably assists in the leaping-powers of the animal possessing it. How far this continuation downward is present in orders other than Carnivora we do not at present know.

The tenuissimus seems to be very constantly present among the Carnivora, though, as it adheres somewhat closely to the deep surface of the biceps, it is apt to be missed unless specially looked for. In the following animals its presence was noticed and in no case, with the exception of that of *Cynelurus* (12), is it definitely stated that the muscle was absent:—*Felis leo* (1, 2, 3), *F. tigris* (4), *F. pardus* (5, 6, 7), *F. pardalis* (8), *F. catus* (9), *Cryptoprocta* (13, 14, 15), *Viverra* (16, 17), *Viverricula* (19), *Genetta* (20, 23, 24), *Paradoxurus* (25, 26), *Herpestes* (29, 30), *Cynictis* (31), *Hyæna striata* (36), apparently in *Hyæna crocuta* (37), *Canis familiaris* (39, 41, 42, 43, 44, 45) (see fig. 1), *C. aureus* (50, 50 a), *C. mesomelas* (51), *Ursus americanus* (58, 59), *Procyon lotor* (63, 64, 65), in one specimen (65) Allen (XXVI.) records that the muscle rose from the third trochanter; *Nasua* (68, 69), *Cercoleptes* (72), *Galictis* (75), *Mustela* (82), *Meles* (85, 86), and *Lutra* (88, 90, 93).

Quadriceps extensor.—The four muscles which make up the quadriceps show little variety in the Carnivora. The rectus (superficialis quadricipitis) is sometimes described as rising by one head, sometimes by two, and it is interesting to note that in some cases the straight head is said to be present, in others the reflected. In the animals which we have ourselves dissected we have paid a good deal of attention to this point, and we feel convinced that there is no real suppression of either head, but that they rise very close together, and that the interval between them is filled up by fibrous tissue, thus giving the appearance of one broad origin. The remaining three parts of the quadriceps—mesialis, lateralis, and profundus—are more or less fused, but the lateralis (*vastus externus*) always exceeds the mesialis (*v. internus*) in size. The profundus quadricipitis (*crureus*) may rise from the whole of the shaft of the femur, but more commonly it misses the upper fourth.

Tibialis anticus.—This muscle rises from the upper two-thirds

or so of the shaft of the tibia, and, when it is well developed, encroaches on the fibula. It never has any origin from the femur as is sometimes the case in rodents. When five toes are present the tendon is inserted chiefly into the base of the first metatarsal, though some of the fibres may go to the entocuneiform. In the Felidæ and Canidæ, where the hallux is rudimentary, the tibialis anticus is inserted into that rudiment; but in the Hyænidæ, where the hallux is quite suppressed, it goes to the base of the second metatarsal bone. In many specimens the tendon or the whole of the tibialis anticus is double; this, however, appears to be an individual variation and is not indicative of any family or genus. For instance, Shepherd describes two tendons in *Ursus americanus* (XX.), but this was not noticed in any other specimen of the same animal. Watson says that in *Hyæna crocuta* the muscle is double halfway down (XV.); this is not the case in any specimen of *Hyæna striata* recorded. In *Mustela foina* Perrin found two tibiales antici (XXIX.), but in Cuvier and Laurillard's specimen (XXXI.) the muscle was entirely undivided.

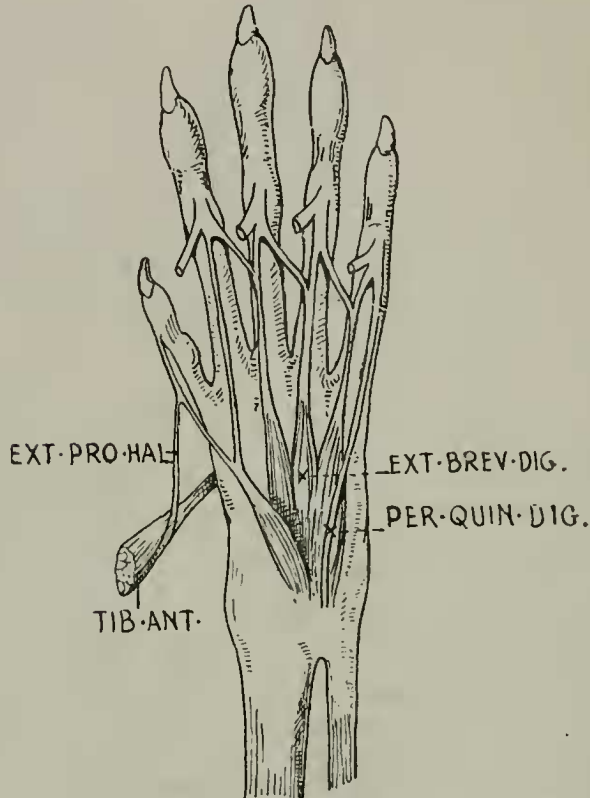
Extensor proprius hallucis.—This muscle, when it is present, rises from some portion of the upper half of the fibula, and is inserted into the dorsum of the base of the terminal phalanx of the hallux. The tendon closely accompanies that of the tibialis anticus, and is often described as coming off from that: careful dissection will, however, always show that the two tendons are really connected with separate fleshy bellies, although they lie in the same synovial sheaths in passing the annular ligament. Among the Felidæ, in spite of the rudimentary condition of the hallux, the extensor hallucis often persists. It was found in *Felis leo* (1), *F. tigris* (4), *F. pardus* (6), and *F. pardalis* (8); on the other hand, it was absent in *F. leo* (2), *F. pardus* (7), and *F. catus* (9). One of us has already noticed (XLI.) that in Rodents this muscle is more persistent than the toe which it should move. When the toe has disappeared and the muscle remains, the latter acquires an insertion into the slip of the extensor longus digitorum to the second toe. Among the Viverridæ, the muscle is present in the following animals:—*Cryptoprocta* (13, 14); *Viverra* (16, 17); *Viverricula* (19); *Genetta* (20, 22, 23, 24), in one specimen (20) it ended in an expansion to the first and second digits; *Paradoxurus* (25, 26). In *Herpestes* the muscle was present in one specimen (29), absent in another (30) (see fig. 3). In *Cynictis* (31) it joined the slip of the extensor brevis digitorum to the inner toe. In *Proteles* and the Hyænidæ it appears to be always wanting (32, 33, 34, 35, 36, 37). Among the Canidæ, it is usually absent in *Canis familiaris* (43, 44, 45, 46, 48) and *C. lagopus* (53), but it was found in two specimens of *C. aureus* (50, 50 a), and in one of *C. mesomelas* (51).

In the Ursidæ it has been seen in *Ursus arctos* (57) and *U. americanus* (58, 62).

In the Procyonidæ it is present in the following animals:—*Procyon lotor* (63, 64, 66), *P. cancrivorus* (67), *Nasua* (68, 70), and *Cercoleptes* (72). In one specimen of *Procyon lotor* (65) Allen

(XXVI.) failed to find it. Among the Mustelidæ it was found in every case in which it was looked for:—*Galictis* (75), *Mustela foina* (78, 79), *Ictonyx libyca* (84), *Meles* (85, 86), and *Lutra* (88, 93).

Fig. 3.

Muscles of hind foot of *Herpestes* (dorsal view).

Extensor longus digitorum.—This muscle has the typical mammalian arrangement: it rises from the front of the outer condyle of the femur by a tendon which passes through the knee-joint; on reaching the leg it expands into a muscular belly, which in the lower third again becomes tendinous and passes through a strong fibrous loop, which binds it to the calcaneum. After this a slip is given off for the middle and distal phalanges of each of the four outer toes. The above description is very constant for the Carnivora. Occasionally the fleshy belly may be more or less divided into two, as in *Ursus americanus* (59) and Meckel's specimen of *Hyæna striata* (34), though this was not noticed in other Hyænas (33, 35, 36). Occasionally one or more of the four tendons may be wanting; in *Procyon cancrivorus* (67) and *Hyæna crocuta* (37) it is the tendon to the fifth toe which is absent, but in one of Allen's Racoons (65) the only tendons present were those to the second and fifth toes.

Extensor brevis digitorum.—This muscle rises from the anterior part of the dorsal surface of the calcaneum and divides into tendons which join those of the extensor longus. As a rule tendons pass to the four inner toes, but occasionally a slender slip runs to the fifth also. In the Felidæ, where the hallux is aborted, there are only three tendons for the 2nd, 3rd, and 4th toes; this is the case in *Felis leo* (1, 2), *F. tigris* (4), and *F. catus* (9). Among the Viverridæ, tendons are given off to the four inner toes in *Cryptoprocta* (13), *Viverra* (16), and *Genetta* (22, 23, 24). The specimen of *Herpestes griseus* (30) which we dissected was remarkable for having slips of the extensor brevis to all five toes (see fig. 3). *Proteles* (32), on the other hand, has only tendons to the second and third toes. Among the Hyænidæ there are always tendons to the 2nd, 3rd, and 4th toes (33, 34, 35, 36, 37), and, in addition, a feeble slip went to the fifth in two specimens of *Hyæna striata* (33, 36). The Canidæ resemble the Hyænidæ in the absence of the hallux; consequently we find tendons running to the 2nd, 3rd, and 4th toes in *Canis familiaris* (48), *C. aureus* (50 a), and *C. mesomelas* (51). In one Dog (39) a small slip went to the fifth toe in addition.

The Ursidæ and Procyonidæ have tendons to the 1st, 2nd, 3rd, and 4th toes: this is the case in *Ursus arctos* (57), *U. americanus* (59, 62), *Procyon lotor* (63), *P. cancrivorus* (67), *Nasua* (70, 71), and *Cercoleptes* (72, 73, 74). In *Ursus maritimus* (55) and one specimen of *Procyon lotor* (64) the tendon to the hallux was absent. The Mustelidæ resemble the Ursidæ and Procyonidæ in usually having tendons for the 1st, 2nd, 3rd, and 4th toes: these were present in *Galictis vittata* (75), *Mustela putorius* (77), *M. foina* (78), *Meles* (86), and *Lutra* (93). In *Ictonyx libyca* (84) and *Lutra* (88) the slip to the hallux was absent.

Peroneus longus.—This muscle rises from the head and upper part of the shaft of the fibula, occasionally encroaching on the adjacent portion of the tibia. Some of the fibres of the external lateral ligament of the knee are continuous with its origin. The tendon of insertion runs in a separate groove on the outer side of the external malleolus, turns round the cuboid, and passes across the sole of the foot to be inserted into the base of the first or, when that is absent, the second metatarsal bone. With regard to the origin, Ruge (XLVIII.) states that in *Hyæna*, *Nasua*, and *Meles* it comes from the external condyle of the femur. We have failed to find any confirmation of this by other authors, and in our own specimen of *Hyæna* (36) the muscle certainly rose from the fibula. As the tendon passes round the cuboid, a slip is sometimes given to the base of the 5th metatarsal bone: this was noticed by Young and Macalister in *Viverra* (16, 17), and by Mivart in *Genetta* (20). In our own specimen of *Genetta* (23) we paid special attention to this point, and satisfied ourselves that the apparent attachment to the base of the fifth metatarsal belonged to the sheath of the tendon, and not to the tendon itself. In *Proteles* (32) and *Hyæna crocuta* (37), Watson found the tendon ending in the base of the fifth

metatarsal. Young and Robinson (XIV.) state that in the Fox and Dog the peroneus longus is inserted into the cuboid and the 4th and 5th metatarsals. We have examined the insertion very carefully in two Dogs (39, 40), and find that, though the sheath of the tendon is attached to these parts, the tendon itself is continued across the sole, not to the base of the second metatarsal bone, but to that of the rudimentary first.

Peroneus brevis.—This is always present in Carnivora, and rises from the shaft of the fibula below the origin of the peroneus longus. The tendon of insertion, which is large, runs in a groove behind the external malleolus which it shares with the peroneus quinti digiti. It is inserted into the base of the fifth metatarsal bone.

Peroneus quinti digiti.—This is also very constant, although some authors have described it as a slip from the tendon of the peroneus brevis. The muscular belly is very small and easily overlooked; it rises from the upper third or so of the shaft of the fibula, and the delicate tendon passes down in the same groove as that of the peroneus brevis, behind the external malleolus. After reaching the dorsum of the foot, it fuses with the tendon of the extensor longus digitorum to the fifth toe (see fig. 3).

The *Peroneus quarti digiti* is never found in the Carnivora.

Gastrocnemius.—This muscle usually consists of two heads rising from above the two condyles of the femur, though in some cases a third or median head can be separated from the external. In the outer and inner heads fabellæ may be developed, the external one being the more constant; and we have some reason to believe that the ossification of the internal fabella depends on the age of its possessor. The two fleshy bellies unite below the middle of the leg to form the greater part of the tendo Achillis, the fibres of which are twisted in the manner already pointed out by one of us¹. Among the Felidæ, Macalister noticed the presence of a median head in *Felis leo* (1), and Mivart describes four heads to the gastrocnemius of *Felis catus* (9). In *Felis tigris* (4), *Felis pardus* (5, 6), and *Felis pardalis* (8), no median head could be distinguished. Among the Viverridæ only two heads have been recorded. There is always a fabella in the outer head, but in two specimens of *Cryptoprocta* one (13) had an internal fabella and the other (14) had not. In two specimens of *Viverra* (16, 17) the same thing was observed.

In the Canidæ, fabellæ were found in both heads in *Canis familiaris* (39), *Canis aureus* (50 a), and *Canis mesomelas* (51).

In the Ursidæ, Kelley (XXIV.) points out that the gastrocnemius is much smaller in proportion in the Polar Bear than in the Cat. Shepherd (XX.) says that "in *Ursus americanus* (59) the three heads," one of which is evidently the plantaris, "remain distinct as far as their insertion." In Cuvier and Laurillard's specimen of the same animal (62) the two heads unite quite low down in the leg. The Procyonidæ serve very well to show the inconstancy of

¹ "On the Morphology of the Tendo Achillis," by F. G. Parsons. Journ. Anat. vol. xxviii. p. 414.

the internal fabella : in one specimen of *Procyon lotor* (63) it was present, in another (64) it was not. In *Nasua fusca* (69) there were two fabellæ, while in *Nasua narica* (68) only the outer one was seen. Among the Mustelidæ no fabellæ at all were found in *Mustela foina* (79) and *Lutra cinerea* (93), but in *Galictis barbara* (76), *Mustela putorius* (77), *Mustela foina* (80), *Ictonyx* (84), *Meles* (85), and *Lutra* (88) there was an often ill-marked one in the outer head. In the specimen of *Lutra* (88) which we dissected the two heads were separate almost as far as their insertion and resembled very much the condition found in *Castor* (XLI.).

The *Plantaris* rises from the external condyle of the femur and the external fabella, and winds round the inner side of the tendo Achillis till it reaches the calcaneum ; it then usually spreads out into a broad expansion which plays round the posterior surface of the tuberosity of that bone until it reaches the foot, where it is continuous with the flexor brevis digitorum and the plantar fascia. Shepherd, in his specimen of *Ursus americanus* (59), found that the tendon was inserted into the tuber calcis as in man. Watson describes the same arrangement in *Hyæna crocuta* (37), but in no other animals is it recorded.

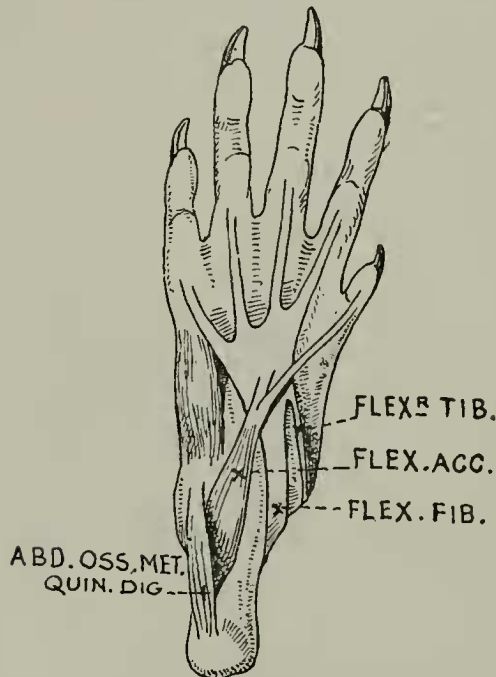
Soleus.—This muscle rises from the back of the head of the fibula ; it is usually a small muscle and in many cases is absent. As a rule it joins the tendo Achillis in the lower third of the leg, but in some cases is inserted directly into the calcaneum. In the Felidæ and Viverridæ the muscle is present and answers the above description—*Felis leo* (1), *Felis tigris* (4), *Felis pardus* (6), *Felis pardalis* (8), *Cryptoprocta* (13, 14), *Viverra* (16, 17), *Viverricula* (19), *Genetta* (20, 22, 24), *Paradoxurus* (25, 26), *Herpestes* (29, 30), and *Cynictis* (31). *Proteles* in this respect differs from the Viverridæ. The Hyænidæ and Canidæ, with which *Proteles* (32) agrees, are remarkable for the total absence of the soleus—*Proteles* (32), *Hyæna striata* (33, 34, 35, 36), *Hyæna crocuta* (37), *Canis familiaris* (39, 40, 43, 44, 45, 46, 48), *Canis aureus* (50, 50 a), *Canis mesomelas* (51), *Canis lagopus* (53), and *Lycaon pictus* (54). In the Ursidæ, Procyonidæ, and Mustelidæ the soleus is present with the exception of the Otter, in which it seems to be sometimes absent : for instance it was absent in our own specimen (88), while in Houghton's (92) it only weighed 0·01 oz. av. ; in two other specimens (90, 93) it was present and well marked.

Popliteus.—This muscle, which is very constant in the mammalian series, rises from the outer side of the external condyle of the femur and is inserted into the upper third or half of the inner border of the tibia. It was present in every animal examined, and frequently contained a sesamoid bone in its tendon of origin. Perrin (XXIX.) notices that in *Cercoleptes* (74) the anterior tibial artery passed above and then in front of it : we found the same arrangement in a Dog (40), but unfortunately the relations of the artery and muscle have not been observed in any other case.

Flexor fibularis (*F. longus hallucis*).—This rises from the upper

three-quarters of the posterior surface of the fibula, from the interosseous membrane, and often from part of the posterior surface of the tibia. It is the largest of the deep flexor muscles on the back of the leg, and its strong flat tendon passes behind the astragalus and below the sustentaculum tali into the sole, where it is joined by the flexor tibialis tendon (see fig. 4). The conjoined tendons now divide for the toes, always giving off slips for the four outer ones and often for the hallux as well. In the Felidæ, Canidæ, and Hyænidæ no slip is present for the aborted hallux; but in the Viverridæ, Ursidæ, Procyonidæ, and Mustelidæ the hallux receives a slip, though it is often more slender than those to the other digits. In *Herpestes griseus* (30) we found that the slip to the hallux, instead of coming from the combined flexor tendons, was a direct continuation of the accessorius, though in *Herpestes nepalensis* (29) it came from the conjoined tendons as usual (see fig. 4).

Fig. 4.

Plantar tendons of foot of *Herpestes*.

Flexor tibialis (*Flexor longus digitorum*).—This rises from the inner part of the posterior surface of the tibia, the fascia over the tibialis posticus, and sometimes from a small part of the back of the upper third of the fibula. The tendon, which is much smaller than that of the flexor fibularis, passes behind the internal malleolus and in the sole joins the inner side of the flexor fibularis, as has already been noticed. The muscle was present and normal in every animal examined.

Lumbricales.—As a rule there are four of these muscles, but

when only three are present the one on the tibial side is missing. Among the Felidæ there are usually three—*Felis leo* (2), *Felis tigris* (4), *Felis pardus* (5, 6), and *Felis pardalis* (8). In one specimen of *Felis leo* (1) Macalister noticed four, two coming from the tendon of the third toe. In the Viverridæ four lumbricales are usually present—*Cryptoprocta* (13), *Viverra* (16), *Genetta* (22, 24), *Herpestes* (30), and *Cynictis* (31). In the following, however, there were only three—*Viverra* (17), *Genetta* (20), and *Proteles* (32). In the Hyænidæ, with which as usual *Proteles* agrees, there are never more than three lumbricales—*Hyæna striata* (33, 34, 35) and *Hyæna crocuta* (37). Young and Robinson state (XIV.) that in *Hyæna striata* (34) the second lumbrical joins the superficial flexor of the second toe, and in Cuvier and Laurillard's plate (XVI.) the same thing seems to occur. The Canidæ have also three lumbricales—*Canis familiaris* (39, 48), *Canis aureus* (50 a), and *Canis mesomelas* (51).

In the Procyonidæ there are usually four lumbricales, but the tibial one is small—*Procyon lotor* (63), *Nasua rufa* (70), *Cercoleptes* (72). In *Procyon lotor* (64) there were only three.

In the Mustelidæ there are also four as a rule—*Mustela foina* (78), *Ictonyx* (84), *Meles* (86), *Lutra* (88, 90). In *Mustela putorius* (77) and *Lutra cinerea* (93) the tibial one was absent.

Tibialis posticus.—This rises from the posterior surface of the tibia below the popliteus and also, sometimes, from a little of the upper part of the back of the fibula; the tendon is very feeble and is inserted into the navicular as a rule, but also into the cuneiforms and bases of the metatarsals. It is present in all the Felidæ and Viverridæ—*Felis leo* (1), *Felis tigris* (4), *Felis pardus* (6), *Felis pardalis* (8), *Felis catus* (9), *Cryptoprocta* (13), *Viverra* (16, 17), *Viverricula* (19), *Genetta* (20, 24), *Paradoxurus* (25, 26), *Herpestes* (29, 30), *Cynictis* (31) (very small), and *Proteles* (32). In the Hyænidæ the muscle may or may not be present; it was absent in one specimen of *Hyæna striata* (33), but present in another (36), while in *Hyæna crocuta* (37) it was absent. In the Canidæ, if the muscle is present at all, it is so feebly developed as to require the greatest care to make it out. Haughton (XVIII.) says that it was absent in two Irish Terriers (41 and another) and a Greyhound (42), while in a Dingo (49) it only weighed 0.01 oz. av. In the Dogs which we dissected (39, 40) we failed to find any trace of it, but in the following it was present although extremely small: 43, 44, 45, 46, 48. In *Canis aureus* (50, 50 a), *Canis mesomelas* (51), and *Canis lagopus* (53), traces of it were found.

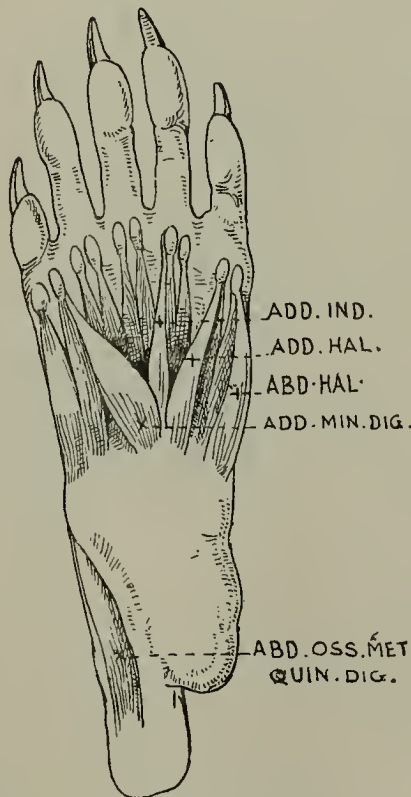
In the Ursidæ (58, 59) and Procyonidæ—*Procyon lotor* (63, 64, 65), *Nasua* (68, 69), *Cercoleptes* (72, 73, 74)—it was present, and in *Procyon lotor* (63) a sesamoid cartilage was found in the tendon where it passed under (plantar to) the short plantar ligament. Among the Mustelidæ the tibialis posticus was present in *Galictis vittata* (75), *Galictis barbara* (76), *Mustela putorius* (77), *Mustela foina* (79), *Ictonyx libyca* (84), *Meles* (85, 86), and *Lutra* (88, 93).

Peroneo-tibialis.—This muscle has been noticed by Gruber (XLVIII.) as being present in 24 out of 30 specimens of *Canis familiaris* as well as in *Canis lupus* and *Canis vulpes*. No other author, to our knowledge, has noticed its presence in the Carnivora. Unfortunately, we only came across Gruber's paper after our animals, with seven exceptions, were dissected, though we feel confident that if the muscle had been at all well developed it would not have escaped our notice. The seven animals which we specially examined without finding the slightest trace of a peroneo-tibialis were *Cryptoprocta* (14), *Cynictis* (31), *Herpestes griseus* (30), *Canis aureus* (50 a), *Canis mesomelas* (51), *Nasua narica* (an extra specimen), and *Cercoleptes* (72). We also procured an additional specimen of *Canis familiaris* and made an extremely careful examination of the posterior tibial region. We are confident that there were no muscular fibres deep to the popliteus passing between the tibia and fibula and corresponding to the rotator fibulæ so well known in the Lemuroidea. Lower down in the leg, however, we came across a few very delicate strips of muscle passing transversely from one bone to the other and with the greatest difficulty separable from the origin of the flexor fibularis. The nerve-supply of these seemed to be from the anterior tibial. We fear that the question of the presence of this muscle throughout the Carnivora must remain for future investigation.

Flexor brevis digitorum.—This muscle is in most cases a direct continuation of the plantaris after the latter has passed round the back of the tuber calcis. It usually has a fleshy belly in the sole, which divides into four slips; these soon become tendinous and form the flexores perforati for the four outer toes. Just before the deep tendons pass through them a fibrous ring is given off which surrounds the deep tendons. Each slip of the flexor brevis, after having been perforated, unites and divides again to be inserted into the middle phalanx. In some cases muscular slips are given off in the sole from the conjoined deep tendons to those of the flexor brevis: these have already been noticed in *Hyæna striata* as displaced lumbricales. The Hyænidæ and Canidæ are remarkable for the absence of muscular fibres in the flexor brevis, which is therefore a mere expanded, fibrous continuation of the plantaris tendon. This arrangement was noticed in *Hyæna striata* (33, 35), *Proteles* (32), *Canis familiaris* (39, 40), *Canis aureus* (50, 50 a), *Canis mesomelas* (51), and *Canis lagopus* (53). In *Hyæna crocuta* (37) there was not only no fleshy belly to the flexor brevis, but that muscle was not continuous with the plantaris, which ended in the tuber calcis. Kelley (XXIV.) noticed that in *Ursus maritimus* (55) the flexor brevis was only fleshy for the 2nd and 3rd toes, the tendons for the 4th and 5th being continuous with the plantaris. In *Ursus americanus* (59) the flexor brevis rose entirely from the calcaneum, though in the other Bears (55, 57, 58, 62) the usual arrangement existed. In one specimen of *Viverra* (17), Macalister found no tendon to the outermost toe.

Accessorius.—This muscle is usually present in the Carnivora; it rises from the under and outer side of the calcaneum and is inserted into the conjoined tendons of the flexores fibularis and tibialis, usually on their plantar surface. In the Felidæ it is short and transverse—*Felis leo* (1, 2), *Felis tigris* (4), *Felis pardus* (5, 6), *Felis pardalis* (8), *Felis catus* (10). In the Viverridæ it is also present but is more antero-posterior: in many instances the innermost fibres of the muscle were continued on into the hallux; this was the case in *Cryptoprocta* (13, 14), *Viverra* (16), *Genetta* (24), *Paradoxurus* (25), and *Herpestes* (29). In *Herpestes* (30), as we have already mentioned under the head of the flexor fibularis, the accessorius formed the whole of the only flexor tendon to the hallux (see fig. 4).

Fig. 5.

Plantar muscles of foot of *Procyon*.

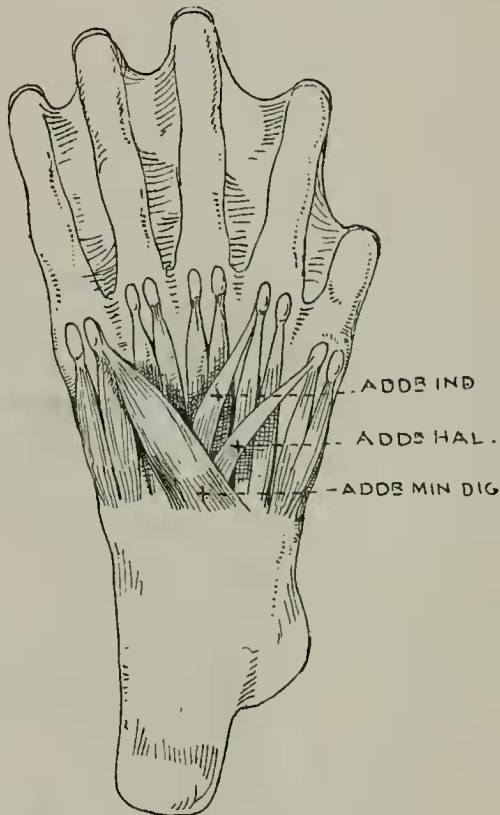
Among the Hyænidæ the muscle was absent in *Hycena striata* (33, 36), and also in *Proteles* (32), but it was found in *Hycena crocuta* (37). The Canidæ are remarkable for the frequency with which this muscle is absent: this was the case in *Canis familiaris* (39, 40, 43, 44, 45, 46, 48), *Canis aureus* (50), *Canis mesomelas* (51), and *Canis lagopus* (53). In *Canis aureus* (50 a) and *Lycaon pictus* (54) the accessorius was present. In the other families

the muscle was present in every case, and calls for little notice except that it tends to form a large part of the long tendon for the hallux.

Abductor ossis metatarsi quinti.—This muscle was frequently noticed: when present it rises from the posterior part of the calcaneum and is inserted into the base of the fifth metatarsal bone. In some cases a slip was continued on to the base of the proximal phalanx of the fifth toe, forming a feeble abductor minimi digiti, but more often it was absent (see fig. 5).

Abductor hallucis.—This is usually present in the families in which the hallux is not aborted (see fig. 5). In the *Felidæ*, *Canidæ*, and *Hyænidæ* it is absent.

Fig. 6.

Muscles of sole of foot of *Lutra*.

Adductor Muscles of the Foot. First Layer of Deep Muscles.—As in the hand, the usual arrangement is to find three adductors—one for the hallux, one for the index, and a third for the minimus (see figs. 5 & 6). As the hallux is suppressed in the *Felidæ*, *Canidæ*, and *Hyænidæ*, there is, of course, no adductor hallucis in these families. In *Felis pardus* (6) and *pardalis* (8) there were two adductors of the fifth digit. In *Viverra* (17) Macalister found an

adductor of the annularis instead of the index, but in *Viverricula* (19) the arrangement was normal.

Second Layer of Deep Foot Muscles.—A double-headed flexor brevis was found in each toe in all the specimens examined (see fig. 6). Of course in the Felidæ, Hyænidæ, and Canidæ the muscle for the hallux was absent.

Third Layer of Deep Foot Muscles.—In no animal could we find any muscles dorsal to the ones last described. Allen, too, looked for them in *Procyon* (64, 65), and Young and Robinson in *Hyæna* (33), but without success.

Muscles of the Trunk.

Rectus ventralis (Rectus abdominis).—This muscle rises from the pubic symphysis and runs forwards to be inserted into several of the anterior ribs at their junction with the sternum, the insertion into the first rib being always the best marked. In *Canis familiaris* (39) we noticed that the fleshy part of the muscle ended opposite the 6th rib cartilage, anterior to which it was continued by a fibrous sheet to the first rib. (See Part I. of this paper, P. Z. S. 1897, p. 382, fig. 6.) In *Hyæna striata* (35) the same arrangement existed. The lineæ transversæ may be quite evident or so indistinct as to be overlooked: there are usually between 5 and 8 of them, but they are not constant in two individuals of the same species; for instance, Testut (XXIII.) noticed eight in *Ursus americanus*, while Meckel (XXXIX.) and Cuvier and Laurillard (XXII.) only found five in the same animal. Five, however, seems to be the commonest number.

The *Pyramidalis* is seldom sufficiently well-marked to be noticed as a distinct muscle. In most of the animals which we dissected it was looked for and found closely incorporated with the rectus. Murie (XVII.) describes it as wanting in *Hyæna brunnea*, as do also Young and Robinson (XIV.) in *Hyæna striata* and Alix (XXX.) in *Mustela putorius*. Shepherd, however, says that it is large and distinct in *Ursus americanus*.

Supracostalis.—There can be little doubt that this muscle is a continuation forward of the external oblique plane; it is very constant in the Carnivora, and was found in every animal in which it was looked for. It rises from the sternum at the junction of the 2nd and 3rd costal cartilages, and runs outward and forward to be inserted into the first rib about the middle. Some of its fibres are occasionally continued into the scalenus brevis.

The *External Oblique* rises from the posterior 8 to 10 ribs by separate digitations, and the muscle runs inward and backward to the symphysis and linea alba; it is easily separable from the surface of the rectus ventralis in the posterior part of the abdomen, but less easily in the anterior. In the dorsal part of the abdominal wall it is continuous with the lumbar aponeurosis, and there is no fleshy insertion into the crest of the ilium. In *Ictonyx libyca* (84) we noticed double digitations from the posterior two or three ribs.

The *Internal Oblique* rises from the lumbar fascia, the crest of

the ilium, and Poupart's ligament. It is inserted into the posterior two to five ribs and the linea alba.

We have noticed in several animals that the aponeurosis of this muscle, instead of dividing to enclose the rectus, passes superficially to it, and Shepherd (XX.) has observed the same in *Ursus americanus*. In male Carnivora the internal oblique forms, at all events, the greater part of the scrotal pouch.

The *Transversalis* rises from the internal surfaces of the posterior six or more ribs and from the lumbar fascia; it is only fleshy in the dorsal and anterior part of the abdomen. In some animals it splits to enclose the rectus, but it is difficult in many cases to be sure of this point.

The *Psoas magnus* rises from the posterior three or four thoracic and all the lumbar vertebræ. It is joined by the iliacus and inserted into the lesser trochanter.

The *Psoas parvus* is always present in Carnivora, it rises from the anterior lumbar vertebræ, internal to the magnus, and is inserted into the ilio-pectineal line.

The *Iliacus* is always a small muscle, and has the usual origin from the venter of the ilium. Its insertion is with the psoas.

Quadratus lumborum.—This muscle is very difficult to distinguish, as it tends to fuse with the psoas ventrally and the erector spinæ dorsally; it usually consists of fibres running from the lumbar transverse processes to the crest of the ilium, the costo-vertebral portion being undifferentiated.

Serrati dorsales.—These muscles show great variety in the number of ribs to which they are attached, as well as in the degree of their fleshy development. They also vary in the number of ribs to which they are attached in different specimens of the same animal. For these reasons we think it needless to encumber this paper with the exact number of attachments in each animal dissected, but will content ourselves with saying that the serratus dorsalis thoracis (serratus posticus superior of human anatomy) is always a larger muscle than the serratus dorsalis lumbalis (serratus posticus inferior), and that it is usually attached to some 8 or 10 ribs, beginning at the 2nd or 3rd. The serratus dorsalis lumbalis, on the other hand, is small and is often absent altogether. When it is present, it is attached to three or four posterior ribs, and in those cases in which the two muscles overlap, it is always the lumbalis which is superficial. In Cuvier and Laurillard's plate of the Badger's muscles (XXXIII.), the lumbar part of the serratus dorsalis is inserted into the eight anterior ribs and no thoracic portion is present. Unfortunately we have not had an opportunity of checking this observation.

Erector spinæ.—The three portions of this mass known in human anatomy as the sacro-lumbalis, longissimus dorsi, and spinalis dorsi are present in the Carnivora. In *Felis leo* and *Felis pardus*, Cuvier and Laurillard (V., VI.) point out that the sacro-lumbalis is not continued back as far as the sacrum and ilium, but only reaches the rib. In these animals, apparently, only that part of

the outer layer corresponding to the human accessorius is present. In no case have we been able to satisfy ourselves that the sacrolumbalis and accessorius are continued up into the neck as the cervicalis ascendens. The longissimus dorsi is continued up to the dorsal tubercles of the transverse processes of the posterior five or six cervical vertebræ as the transversalis colli.

The *Transversalis capitis* (*Trachelo-mastoid*) is always present in the Carnivora; it is practically a continuation forward of the longissimus dorsi. It rises from the posterior three or four cervical and the anterior one or two thoracic vertebræ, and is inserted into the skull deep to the outermost fibres of the splenius capitis. In *Ursus americanus* (60) a slip is given from it to the transverse process of the atlas. In *Ictonyx libyca* (84) and *Lutra vulgaris* (88) we noticed that the trachelo-mastoid was distinctly bilaminar with the ventral margins fused. Sometimes the muscle has a tendinous intersection running across it, but this is not nearly so frequently the case as in the complexus.

Complexus.—The mesial part of the complexus which, in human anatomy, is called biventer cervicis is always marked off from the lateral part or complexus proper; it rises from the anterior two or three thoracic vertebræ, and usually has from one to four transverse intersections in its course. The lateral part of the complexus rises from the anterior one or two thoracic and the posterior four cervical vertebræ; it sometimes has one or two intersections, but they are never as numerous so in the complexus mesialis. As it approaches its insertion into the occipital bone the muscle usually becomes tendinous. In certain of the Carnivora, e. g. *Felis catus* (9) and *Ursus maritimus* (55), a complexus tertius has been noticed, lying externally to the rest, rising from the 2nd, 3rd, and 4th cervical vertebræ, and being inserted into the transverse process of the atlas.

Suboccipital triangle.—The muscles of this triangle call for little remark, except to notice that the rectus capitis dorsalis (posticus) major is divided into a superficial and a deep layer. This arrangement is common in other animals besides the Carnivora, and we have proposed to describe three dorsal recti of the head, and to name them superficialis, medius, and profundus, the latter corresponding to the rectus capitis posticus minor of human anatomy.

The *Splenius capitis* is a very constant muscle rising from the ligamentum nuchæ and anterior thoracic spines, and being inserted into the curved line of the occipital bone.

The *Splenius colli* is usually absent in Carnivora. In *Hycena striata* (33), however, Young and Robinson found it, and Cuvier and Laurillard represent it as a very large muscle in the same animal (35). In *Hycena crocuta* (37) and *Proteles* (32), on the other hand, Watson says that the muscle is absent. In two Dogs, of which we have records (39, 48), there was no splenius colli; while among the Viverridæ it was noticed by Young in one specimen of *Viverra civetta* (16), but not by Macalister and Meckel in other specimens of the same animal. Among the Felidæ, Ursidæ,

Procyonidæ, and Mustelidæ the muscle has, so far as we know, not been observed except in *Lutra cinerea* (93), in which Macalister describes it as feeble.

Myological Characteristics of the various Families of Carnivora.

FELIDÆ.

- (1) Sterno-mastoids of opposite sides do not fuse in the mid-ventral line.
- (2) The omo-hyoid is never present.
- (3) The cephalo-humeral usually reaches the forearm.
- (4) The pronator radii teres is inserted into the middle of the radius.
- (5) The palmaris longus externus alone is present.
- (6) The pronator quadratus occupies the lower half of the radius and ulna.
- (7) The supinator longus is present (except in *Cynelurus*).
- (8) The flexor brevis digitorum manûs is usually present.
- (9) The caudo-femoralis (agitator caudæ) usually reaches the patella.
- (10) The ilio-tibialis (sartorius) is usually single.
- (11) The semitendinosus never has a caudal head.

VIVERRIDÆ.

- (1) The sterno-mastoids of opposite sides seldom fuse.
- (2) The omo-hyoid is seldom present.
- (3) The rhomboideus capitis is seldom seen.
- (4) The subclavius is sometimes present.
- (5) The cephalo-humeral usually reaches the forearm.
- (6) The pronator radii teres is inserted into the middle of the radius.
- (7) There may be a palmaris longus externus, internus, or both.
- (8) The pronator quadratus is very variable.
- (9) The supinator longus is present.
- (10) The flexor brevis digitorum manûs is often present.
- (11) The caudo-femoralis is inserted into the lower third of the femur.
- (12) The ilio-tibialis (sartorius) may be single or double.
- (13) The semitendinosus always has a caudal head.

HYÆNIDÆ.

- (1) The mylo-hyoid does not reach as far forward as the symphysis menti.
- (2) The omo-hyoid is usually absent.
- (3) The rhomboideus capitis is seldom present.
- (4) The cephalo-humeral is inserted into the humerus.
- (5) The pronator radii teres is inserted into the middle of the radius.

- (6) The *palmaris longus externus* alone is present.
- (7) The *flexor profundus digitorum* does not usually send a slip to the pollex.
- (8) The *pronator quadratus* occupies the whole length of the radius and ulna.
- (9) The *supinator longus* is absent.
- (10) The *flexor brevis digitorum manûs* is rarely present.
- (11) The *cando-femoralis* is absent.
- (12) The *ilio-tibialis* is double.
- (13) The *semitendinosus* never has a caudal head.
- (14) The *solens* is absent.
- (15) The *flexor brevis digitorum pedis* has no fleshy belly in the sole.
- (16) The *tibialis posticus* is often absent.
- (17) The *accessorius* is often absent.

CANIDÆ.

- (1) The *mylo-hyoid* does not reach the *symphysis menti*.
- (2) The *omo-hyoid* is always absent.
- (3) The *rhomboideus capitis* is always present.
- (4) The *cephalo-humeral* is inserted into the humerus.
- (5) The *pronator radii teres* is usually inserted above the middle of the radius.
- (6) The *palmaris longus* is usually absent.
- (7) The *pronator quadratus* occupies the whole length of the radius and ulna.
- (8) The *supinator longus* is absent.
- (9) The *flexor brevis digitorum manûs* is absent.
- (10) The *cando-femoralis* is absent.
- (11) There is no *glutens ventralis* (*quartus*).
- (12) The *ilio-tibialis* is usually double.
- (13) The *semitendinosus* never has a caudal head.
- (14) The *solens* is absent.
- (15) The *tibialis posticus* is absent or very rudimentary.
- (16) The *flexor brevis digitorum pedis* has no fleshy belly in the sole.
- (17) The *accessorius* is usually absent.

URSIDÆ.

- (1) The *omo-hyoid* is always present.
- (2) The *rhomboideus capitis* may or may not be present.
- (3) The *cephalo-humeral* is inserted into the humerus.
- (4) The *flexor longus cubiti* (*biceps*) is almost always *bicipital*.
- (5) The *coraco-brachialis longus* is present.
- (6) The *pronator radii teres* is inserted into the lower end of the radius.
- (7) The *palmaris longus* is often absent.
- (8) The *pronator quadratus* is attached to the lower third of the radius and ulna.
- (9) The *supinator longus* is present.

	<i>Felidæ.</i>	<i>Fiverridæ.</i>	<i>Hyenidæ.</i>	<i>Canidæ.</i>	<i>Ursidæ.</i>	<i>Procyonidæ.</i>	<i>Mustelidæ.</i>
Sterno-mastoid fusing in mid line.	Never.	Seldom.	Often.	Often.	Often.	Often.	Often.
Omo-hyoid	Absent.	Seldom present.	Usually absent.	Absent.	Present.	Usually absent.	Usually present.
Insertion of Cephalo-humeral.	Usually fore-arm.	Usually fore-arm.	Humerus.	Humerus.	Humerus.	Humerus.	Humerus.
Rhomboideus capitis...	Present.	Usually absent.	Usually absent.	Present.	Present or absent.	Present.	Present.
Rhomboideus profundus as a distinct muscle.	Absent.	Absent.	Absent.	Absent.	Absent.	Sometimes present.	Always present.
Flexor longus cubiti (Biceps).	One head.	Almost always one head.	One head.	One head.	Two heads.	Sometimes two heads.	One head.
Coraco-brachialis medius and longus.	Absent.	Absent.	Absent.	Absent.	Present.	Sometimes present.	Sometimes present.
Subclavius	Absent.	Sometimes present.	Absent.	Absent.	Absent.	Absent.	Absent.
Head of Extensor cubiti (Triceps) from angle of scapula.	Absent.	Absent.	Absent.	Absent.	Absent.	Absent.	Present.
Pron. radii teres insertion.	Mid. of radius.	Middle.	Middle.	Above middle.	Lower end.	Lower end.	Lower end.
Pulmaris longus	Externus.	Extern., intern., or both.	Externus.	Neither.	Both often absent.	Both usually present.	Externus.

	Join high up.	Inconstant.	Inconstant.	Remain distinct.	Remain distinct.	Remain distinct.	Usually join high up.	Inconstant.
2 Heads of Fl. carpi ulnaris.								
Pollex tendon of Fl. prof. dig.	Present.	Absent.		Present.			Present.	Present.
Pronator quadratus ...	Lower $\frac{1}{2}$ of forearm.	Variable, but not to whole length.	Whole length.	Whole length.			Variable.	Variable.
Supinator longus	Present (except <i>Cynelurus</i>).	Present.	Absent.	Absent.			Present.	Present.
Fl. br. dig. manus ...	Present.	Often present.	Usually absent.	Absent.			Usually present.	Seldom present.
Agitator caudæ (caudofemoralis).	Present (usually reaches patella).	Present into lower $\frac{1}{3}$ femur.	Absent.	Absent.			Present or absent.	Present or absent.
Gluteus ventralis (G. quartus).	Usually present.	Usually present.	Present or absent.	Usually present.			Usually absent.	Usually present.
Ilio-tibialis (Sartorius)	Usually single.	Single or double.	Double.	Usually double.			Usually single.	Usually single.
Semitendinosus (caudal head).	Never present.	Always present.	Never present.	Never present.			Always present.	Present or absent.
Soleus.....	Present.	Present.	Absent.	Absent.			Present.	Present.
Tibialis posticus	Present.	Present.	Often absent.	Usually absent.			Present.	Present.
Fl. brev. dig. pedis. ...	Present.	Present.	Absent.	Absent.			Present.	Present.
Accessorius pedis	Present.	Present.	Absent.	Absent.			Present.	Present.

- (10) The supinator brevis occupies the upper three quarters of the radius.
- (11) The flexor brevis digitorum manûs is usually absent.
- (12) The caudo-femoralis is absent.
- (13) The ilio-tibialis is usually single.
- (14) The semitendinosus never has a caudal head.

PROCYONIDÆ.

- (1) The omo-hyoid is usually absent (it is present in *Cercoleptes*).
- (2) The rhomboideus profundus is sometimes present (*Cercoleptes*).
- (3) The rhomboideus capitis is always present.
- (4) The cephalo-humeral is inserted into the humerus.
- (5) The flexor longus cubiti (biceps) is sometimes bicipital.
- (6) The pronator radii teres is usually inserted into the lower end of the radius.
- (7) Both palmaris longus externus and internus are usually present.
- (8) The pronator quadratus is variable.
- (9) The supinator longus is present.
- (10) The flexor brevis digitorum manûs is usually present.
- (11) The caudo-femoralis may be present or absent.
- (12) The ilio-tibialis is usually single.
- (13) The semitendinosus always has a caudal head.

MUSTELIDÆ.

- (1) The omo-hyoid is usually present.
- (2) The rhomboideus profundus is always present.
- (3) The rhomboideus capitis is always present.
- (4) The cephalo-humeral is inserted into the humerus.
- (5) The triceps has an extra head from the angle of the scapula.
- (6) The pronator radii teres is usually inserted into the lower end of the radius.
- (7) There is usually only a palmaris longus externus.
- (8) The pronator quadratus is variable.
- (9) The supinator longus is present.
- (10) The flexor brevis digitorum manûs is usually absent.
- (11) The caudo-femoralis may be present or absent.
- (12) The ilio-tibialis is usually single.
- (13) The semitendinosus may or may not have a caudal head.

With the view of making the characteristics of the various families more evident, we have arranged them in a tabular form (see pp. 180, 181).

We propose to close this paper with an examination of how far the study of the muscles helps towards determining the position of one or two of the Carnivora the affinities of which are somewhat doubtful. In the first place, the Cheetah (*Cynælurus jubatus*) is known to differ from the rest of the Felidæ in having only partially retractile claws and a carnassial tooth without an inner lobe. When one examines its muscular structure one notices that in

many respects it more closely approaches the Canidæ than the Felidæ. The following are the chief Feline characteristics :—

- (1) The ilio-tibialis (sartorius) is single.
- (2) The caudo-femoralis (agitator caudæ) reaches the patella.
- (3) The gluteus ventralis (quartus) is present.

The following are the chief Canine characteristics :—

- (1) The pronator quadratus reaches as far as the oblique ligament, *i. e.* to close to the top of the radius and ulna.
- (2) The supinator longus is absent.
- (3) Only the tendon of the tibialis posticus is present.
- (4) The accessorius is absent.
- (5) The flexor brevis digitorum pedis has no muscular fibres in the sole.

The following two points are common to both Felidæ and Canidæ, but go to show that the animal has no Viverrine tendencies :—

- (1) The subclavius is absent.
- (2) The semitendinosus has no caudal head.
- (3) The rhomboideus capitis is present.

We should like to emphasize the fact that we have never had an opportunity of dissecting a specimen of *Cynelurus*, and that our facts are gained from Ross's description. This is in some ways an advantage because his account is an absolute statement of facts set down without any view of proving a theory ; it is a disadvantage because there are many points on which we would like detailed information which necessarily seemed of little or no importance to him.

The Fossa (*Cryptoprocta ferax*) of Madagascar is another animal about whose position systematists are not quite agreed. We have dissected two specimens of this animal (13, 14), and Beddard (VII.) has published some notes on the myology of a third. So far as its muscles go we regard it as a most typical viverrine animal, and the three specimens of which we have records agree so well that we feel that we can speak with some confidence on its myology.

The Aard Wolf of South Africa (*Proteles cristatus*) has been placed, in our list of animals, at the end of the Viverridæ in deference to what we believe is the view of most systematists at the present time ; its muscles, however, point to its much closer relationship with the Hyænidæ, and we subjoin the facts on which our opinion is based :—

a. Viverrine tendencies.

- (1) The cephalo-humeral is inserted into the forearm.
- (2) There is a tendon to the pollex from the flexor profundus digitorum.

β. Hyænine tendencies.

- (1) The pronator quadratus occupies the whole length of the forearm.

- (2) The supinator longus is absent.
- (3) The caudo-femoralis (agitator caudæ) is absent.
- (4) The ilio-tibialis (sartorius) is double.
- (5) The semitendinosus has no caudal head.
- (6) There is no soleus.
- (7) There is no fleshy flexor brevis digitorum pedis.
- (8) There is no accessorius pedis.

The South-American Kinkajou (*Cercoleptes caudivolvulus*) is an animal of which we have had the good fortune to dissect two specimens. It is usually looked upon as a typical member of the Procyonidæ, but we have detected two important musteline characteristics in its muscles and one which is distinctly ursine.

Its Musteline tendencies are :—

- (1) The presence of the omo-hyoid.
- (2) The presence of a distinct rhomboideus profundus.

Its Ursine characteristic is :—

- (1) The presence of two heads to the flexor longus cubiti (biceps).

The points characteristic of the Procyonidæ are :—

- (1) The presence of two palmares longi.
- (2) The fusion of the two heads of the flexor carpi ulnaris.
- (3) The absence of a head from the angle of the scapula to the extensor longus cubiti (triceps).
- (4) The presence of the flexor brevis digitorum manûs.

Other myological points of interest are :—

- (1) The pronator radii teres is inserted into the lower end of the radius (common to Ursidæ, Procyonidæ, and Mustelidæ).
- (2) The supinator longus is present (common to Ursidæ, Procyonidæ, and Mustelidæ).
- (3) The caudo-femoralis (agitator caudæ) is present (common to Procyonidæ and Mustelidæ).
- (4) The gluteus ventralis (quartus) is present and distinct (common to Ursidæ and Mustelidæ, not to other Procyonidæ).
- (5) The ilio-tibialis (sartorius) is single (common to Ursidæ, Procyonidæ, and Mustelidæ).
- (6) The semitendinosus has a caudal head (common to Procyonidæ and Mustelidæ).

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